

What is claimed is:

1. An optical transmission apparatus for amplifying data optical signal and outputting it by multiplexing with a supervisory optical signal, comprising:

5 a doped fiber (11) for inputting said data optical signal and a pumping light and for outputting an amplified data optical signal;

a light source (16) for supplying said doped fiber (11) with said pumping light and for supplying with said supervisory optical signal; and  
10

an optical circuit (10) comprising:

a first port for inputting a light from said light source (16);

a second port for inputting said amplified optical signal and for outputting a part of said light, which is inputted from said first port, as a pumping light; and  
15

a third port for outputting the amplified optical signal inputted from said second port and for outputting a part of the light inputted from said first port as the supervisory optical signal.  
20

2. An optical transmission apparatus as defined in Claim 1, wherein said optical circuit (10) further comprises:

a photo coupler (15) for inputting the light from said light source and for dividing it into the pumping light and the supervisory optical signal; and  
25

a bi-directional multiplexer (18) for supplying said doped fiber (11) with said pumping light and for multiplexing said

supervisory optical signal and said amplified optical signal.

3. An optical transmission apparatus as defined in Claim 1, wherein said optical circuit (10) further comprises:

5 a photo coupler (15) for inputting the light from said light source and for dividing it into the pumping light and the supervisory optical signal;

a first optical multiplexer (12) for penetrating said amplified optical signal and for outputting said pumping light into a direction opposing to that of said amplified optical signal,  
10 and

a second optical multiplexer (14) for multiplexing said amplified optical signal and said supervisory optical signal.

4. An optical transmission apparatus as defined in Claim 1, further comprising:

15 a driver (17) for driving said light source, a driving current of which is modulated with a supervisory information.

5. An optical transmission apparatus as defined in Claim 2, further comprising:

20 a driver (17) for driving said light source, a driving current of which is modulated with a supervisory information.

6. An optical transmission apparatus as defined in Claim 3, further comprising:

a driver (17) for driving said light source, a driving current of which is modulated with a supervisory information.

25 7. An optical transmission apparatus as defined in Claim 2, further comprising:

a modulator (19) for modulating said supervisory optical

signal with a supervisory information and obtaining a second supervisory optical signal.

8. An optical transmission apparatus as defined in Claim 3, further comprising:

5 a modulator (19) for modulating said supervisory optical signal with a supervisory information and obtaining a second supervisory optical signal.

9. An optical repeater, for dividing between a data optical signal and a first supervisory optical signal, for amplifying  
10 said data optical signal, and for outputting by multiplexing the amplified data optical signal and a third supervisory optical signal, comprising:

a wavelength divider (92) for dividing between said data optical signal and said supervisory optical signal;

15 a supervisory optical signal receiver (93) for receiving said first supervisory optical signal being divided by said wavelength divider and for inverting into a first supervisory electric signal;

20 a doped fiber (11) for inputting said data optical signal and a pumping light and for outputting an amplified data optical signal;

a light source (16);

a photo coupler (15) for inputting the light from said light source and for dividing it into the pumping light and the  
25 second supervisory optical signal;

abi-directional multiplexer (18) for supplying said doped fiber with said pumping light and for multiplexing said third

supervisory optical signal and said amplified optical signal;

a modulator (19) for modulating said second supervisory optical signal with a second supervisory electric signal and obtaining a third supervisory optical signal; and

5 a controller (94) for receiving said first supervisory electric signal from said supervisory optical signal receiver and for sending out said second supervisory electric signal to said modulator.

10 10. An optical repeater, for dividing between a data optical signal and a first supervisory optical signal, for amplifying said data optical signal, and for outputting by multiplexing the amplified data optical signal and a third supervisory optical signal, comprising:

15 a wavelength divider (92) for dividing between said data optical signal and said supervisory optical signal;

a supervisory optical signal receiver (93) for receiving said first supervisory optical signal being divided by said wavelength divider and for inverting it into a first supervisory electric signal;

20 a doped fiber (11) for inputting said data optical signal and a pumping light and for outputting an amplified data optical signal;

a light source (16);

25 a photo coupler (15) for inputting the light from said light source and for dividing it into the pumping light and the second supervisory optical signal;

an optical multiplexer (12) for penetrating said amplified

optical signal and for outputting said pumping light into a direction opposing to that of said amplified optical signal;

a second optical multiplexer (14) for multiplexing said amplified optical signal and said third supervisory optical  
5 signal;

a modulator (19) for modulating said second supervisory optical signal by use of a second supervisory electric signal and obtaining a third supervisory optical signal; and

a controller (94) for receiving said first supervisory  
10 electric signal from said supervisory optical signal receiver and for sending out said second supervisory electric signal to said modulator.

11. An optical cross-connect equipment for exchanging connection between an input and an output for optical signal,  
15 comprising:

an optical circuit (125) including an optical switch which has a plurality of inputs and a plurality of outputs;

a first optical transmission apparatus (121) being connected to the plurality of inputs of said optical switch;

20 a second optical transmission apparatus (122) being connected to the plurality of outputs of said optical switch; and

a controller (124) for controlling said optical switch on a basis of an information included in said first supervisory  
25 signal.

12. An optical cross-connect equipment as defined in Claim 11, wherein said first optical transmission apparatus (121)

further comprises:

a wavelength divider (92) for dividing between said data optical signal and said first supervisory optical signal; and

a supervisory optical signal receiver (93) for receiving  
5 said first supervisory optical signal being divided by said wavelength divider and for inverting it into a first supervisory electric signal, and said second optical transmission apparatus (122) further comprises:

an optical transmitter (16) for converting the second  
10 supervisory electric signal from said controller into an optical signal and for sending out a second supervisory optical signal; and

a wavelength multiplexer (14) for multiplexing the data signal from said optical circuit and the second supervisory  
15 optical signal wavelength thereof.

13. An optical cross-connect equipment for exchanging connection between an input and an output for optical signal, comprising:

an optical switch (135) having a plurality of inputs and  
20 a plurality of outputs;

a plurality of data signal transmitters (131) being connected to said inputs of said optical switch;

a plurality of data signal receivers (132) being connected to said inputs of said optical switch;

25 an optical transmitter (133, 134) being connected to said outputs of said optical switch; and

a controller (136) for controlling said optical switch

and said optical transmitter.

14. An optical cross-connect equipment as defined in Claim 13, further comprising:

5 a repeater (131-n, 132-n) for connecting said data signal transmitter and said data signal receiver directly.

15. An optical cross-connect equipment as defined in Claim 13, wherein said plurality of data signal transmitters (131) and said plurality of data signal receivers (132) include either another data signal transmitter (131) or data signal receiver 10 (132), being different from them in the transfer bit rate thereof, and said controller (136) controls output power level of said optical transmitters (133, 134) depending on the transfer bit rate.

16. An optical cross-connect equipment as defined in Claim 15 13, wherein said plurality of data signal transmitters (131) and said plurality of data signal receivers (132) include either another data signal transmitter (131) or data signal receiver (132), being different from them in the transfer bit rate thereof, and said controller (136) controls gain of said optical 20 transmitters (133, 134) depending on the transfer bit rate.